THE ELECTRICAL WORLD

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Electric Railways.—II.

(*Continued from page* 157.)

The prime generator, or dynamo, may be of any type. But for economy it must be one which conserves the greatest amount of the energy applied to it by the prime mover. The dynamos of the Gramme and Siemens type are, unquestionably, the best. Whether either one of these two is better than the other, is still in question. The excellences of individual ones of these machines have hitherto depended upon details of manufacture, such as properly proportioning the parts to one another in the particulars of iron in cores of armature and field-magnets, and sizes and lengths of circuit-wires on both.

Of the dynamo-electric machines there are at present three classes, viz: series, shunt, and compound. These terms refer to the plan of winding the field-magnets. Series-wound machines have the armature coils, the field-magnet coils and the external circuit all combined as one circuit, of which the three divisions constitute serial parts. Shunt-wound machines have their armature coils and the external circuit combined serially as one circuit; but the field-magnet coils constitute a comparatively high resistance shunt-circuit derived at the brushes of the machine. Therefore the field-magnet coils and the external circuit may be said to be in "parallel" or "multiple-arc." In these two circuits the electric current generated in the armature is divided. Compound-wound machines are those in which are combined these two plans of winding. Unless these windings be most carefully and specifically balanced for each machine, the machine embodies not only the virtues but the vices of both systems.

Shunt-wound dynamos seem to give the largest returns of utilizable energy. When the parts are properly balanced as to mass and electrical requirements such machines are of constant electromotive force under constant speed of running. This point is worthy of special consideration for various reasons, but mainly because the locomotives on the line are furnished with that which is in practice somewhat analogous to a constant pressure of steam in the ordinary locomotive. This pressure of steam is controlled, so far as it is exerted on the pistons, by the throttle at the hand of the engineer. The difference between the two is this: While the steam engineer can directly regulate at will the pressure of steam on the pistons, the electrical engineer on one of several locomotives on a parallel line can only vary the electromotive force (pressure) of the current on his motor secondarily, as we shall see when we come to consider his locomotive.

Series-wound dynamos used as generators of electric current for electric railways are objectionable, not only because they do not, as at present made at least, utilize a high percentage of the power applied to them; but, as well, because their electromotive force is extremely variable, even under constant speed of rotation. Every variation of resistance and counter-electromotive force on the line is multiplied in the shape of variations in the electromotive force and strength of current at the dynamo; therefore it would be extremely difficult for the engineer to regulate the speed of his locomotive under such variations. This difficulty is increased somewhat in the ratio of the square of the number of locomotives which may be at once upon the line supplied with electrical energy by the dynamo.

Many electric motors have been made, rising from the motion of masses of iron to and from electro-magnets, to the present most approved rotary motors made after the Gramme and Siemens types of dynamos. But it is still in question whether such machines are better as series, shunt or compound-wound.

It would seem that a series-wound motor is best, if the parts be so constituted that the armature and field poles are of equal and opposite magnetic potential under normal speed of rotation, because not only does such a condition promise the best possible utilization of the electrical energy applied, but also such a machine is more ready to act under the varying conditions of load, starting, stopping, up-grade and down-grade of roadway, etc., etc.

Shunt-wound motors have the disadvantage of being decidedly uneconomical unless run at a predetermined rate of speed. At starting, nearly all of the current supplied flows through the coils of the armature, because their resistance is so small compared with that of the field coils. Consequently the current is not utilized, owing to the absence of magnetism of the field magnets. And the armature rotates slowly and feebly at first, but progressively increases in speed and strength because by reason of its motion it generates a counter-electromotive force which causes current to flow through the field-coils, and thus raises the magnetism of the field-magnets, *et seq.*, as in mutual accumulation.

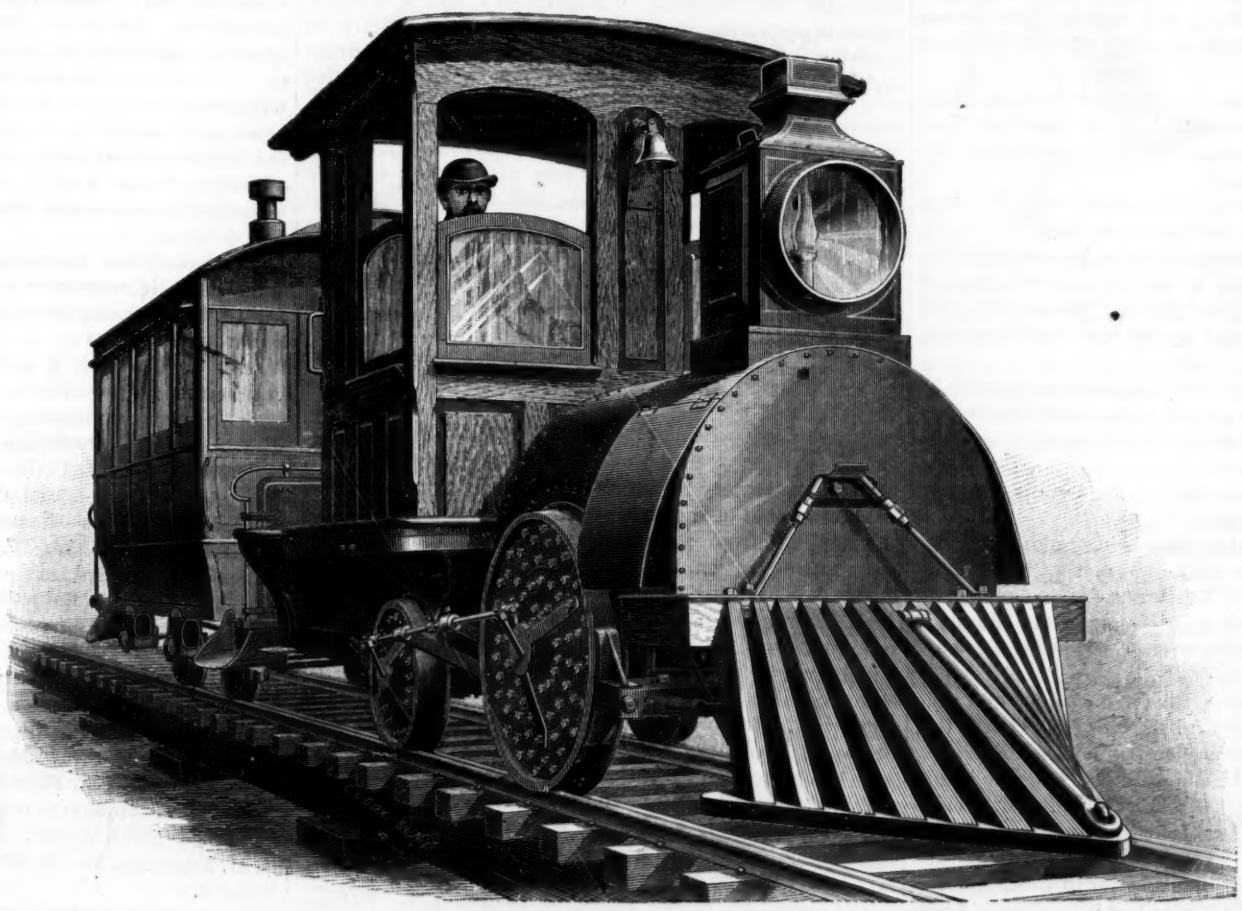
Compound-wound machines start more readily and more energetically, but not with the energy of the series-wound. This must be so, because their full economy of utilization of the electric energy supplied to them depends upon the effects of both windings, and the shunt-winding does not act effectively until a counter-electromotive force is set up. Let us suppose that at starting a series motor, the armature is pulled around by a force exerted by a current of 200 volts and 149.2 ampères in the circuit of the motor. Consider the value of this circuit to be x, we have the equation: $x \times 200 \times 149.2$ = the pull on the periphery of the armature of the motor. But with increased speed comes increase of the counter-electromotive force of the motor, until at a certain speed the counter-electromotive force rises to 100 volts. This action decreases the current through the motor to the values 100 volts and 74.6 ampères, and then the pull on the periphery of the armature $= x \times 100 \times 74.6$.

While the pull to start is greater, and so serves to gradually overcome the inertia of the locomotive and train, it is obtained decidedly uneconomically. This will be seen when we consider that the number of rotations of the armature of the motor in a given time is to be taken into the account. The equations we have given show four times the pull on the armature at starting than when run at a speed at which 100 volts and 74.6 ampéres are used. But the greater pulling force is only exerted for the instant, at say the rate of one turn per minute, while the lesser pull may be exerted at the speed of 1,000 or more turns per minute. So in a minute of time in one case four times the energy would be expended to get one turn of the armature, than would be expended in the other case to get 1,000 turns.

Let us consider this still further. Suppose that at 2,000 turns of the armature of the motor, a counter-electromotive force equal to 200 volts would be generated. Under this condition no current would pass to the motor, and it would be running by reason of momentum from some other cause, such as down grade of track, etc. Of course this could not be on level or on up-grade, but it is evident that a point of equilibrium will in practice be attained where the pull from the imparted energy multiplied by the speed of rotation represents the highest possible efficiency of the apparatus, under the conditions. Because for a given time low difference between electromotive forces of generator and motor and high speed of motor combined point to the highest efficiency, it is best to have the motor constructed for high speeds of rotation.

It follows from the preceding considerations that an electro-locomotive will run slowly on up-grade and fast on a down-grade; and in the latter case even to a speed at which its motor will exert an electromotive force greater than that of the generator, and thus contribute electrical energy to the other locomotives, if any, on the line.

High speed of motor, then, being compatible with economy, it follows that all regulators of speed and traction of the locomotive should be made to act by increasing or decreasing the leverage of the motor on the wheels of the locomotive—mechanical in place of electrical regulators. Any arrangement which allows of current passing through the motor without imparting to it the greatest possible amount of its energy is simple wasteful. Resistances external to the motor are also wasteful, because the energy of the current passed through them is not in any way utilized.



EDISON'S ELECTRIC LOCOMOTIVE.

We give this week an illustration of Mr. Edison's electric locomotive as it appears on the 2½ miles of track built and operated by him at his home in Menlo Park, New Jersey. The description of it and its accessories we leave till its turn comes to be considered in detail.

(TO BE CONTINUED.)

Transmission of Power in Boston.

Within the past few months there has very quietly been formed in Boston a company for the purpose of introducing in practical use in New England the electric motors of Leo Daft, the New Jersey electrician and inventor. Among the directors are Montgomery Sears, Charles Whittier (President of the Whittier Machine Company), George R. Blanchard (Vice-President of the Erie Railroad), Louis Belknap (Treasurer of the Northern Pacific Railroad), Joseph T. Bailey (President of the Boylston National Bank of Boston), Mr. D. W. Russell, Mr. E. C. Pike and others. Their first Boston generator (a 6 h. p. machine) is at 12 Federal street, and motors are now practically working at the printing office of J. S. Adams, 299 Washington street, and at the stamp-works of Dimond & Co., 22 Milk street.

Automatic Fast-Speed Telegraphy.

BY THEO. F. TAYLOR.

Since 1838 much has been done towards increasing the carrying capacity of a single wire. In response to your invitation I will relate my experience upon the Postal's large coppered wire, in an effort to transmit 800 words per minute over a 1,000-mile circuit, and add my mite to the vast sum of knowledge already possessed by electricians.

As an introduction, I shall mention a few historical facts, but do not propose to write in this article even a short account of the different automatic systems, and I must assume that my readers are familiar with modern automatic machines and appliances.

In 1870, upon the completion of the Automatic Company's 7-ohm wire between New York and Washington, it happened that Prof. Moses G. Farmer was in the Washington office when the first message was about to be sent, and upon being requested, he turned the "crank" and transmitted the message to New York, at the rate of 217 words per minute.

Upon his return to New York he co-operated with Mr. Prescott in experiments on W. U. wires, their object being to determine what could be done on iron wires with the Bain system. A good No. 8 wire running from New York to Boston was selected, re-insulated, well trimmed and put in first-class electrical condition, previous to the test. The "Little" chemical paper was used.

The maximum speed attained on this wire was 65 words per minute.

About the same time George H. Grace used an electro-magnet on the automatic line with such good effect that the speed on the New York-Washington circuit was increased to 450 words per minute.

Then a platina stylus or pen was substituted for the iron pen in connection with iodide paper, and the speed increased to 900 words per minute.

In 1880, upon the completion of the Rapid Company's 6-ohm wire, between New York and Boston, 1,200 words per minute were transmitted between the cities above named.

In 1882, I was employed by the Postal Telegraph Company to put the Leggo automatic system into practical shape, and, if possible, transmit 800 words per minute between New York and Chicago.

It was proposed to string a steel-copper wire, the copper on which was to weigh 500 lbs. to the mile.

When complete, the wire was rather larger than No. 3, English gauge, but varied in diameter, some being as large as No. 1, and it averaged 525 lbs. of copper per mile and = 1.5 ohms. The surface of this wire was, however, large.

Dr. Muirhead estimated its static capacity at about 10 M. F., which subsequent tests proved to be nearly correct.

It will be understood that this static capacity stood in the way of fast transmission.

Resistance and static capacity are the two factors that determine speed of signaling.

The duration of the variable state is in proportion to the square of the length of the conductor, so that the difficulties increase very greatly as the wire is extended beyond ordinary limits. According to Prescott, "The duration of the variable condition in a wire of 500 miles is 250,000 times as long as in a wire of 1 mile."

In other words, a long line *retains a charge*, and time must be allowed for at least a falling off of the charge to a point indicated by the receiving instrument as zero.

In the construction of the line care was taken to insure the *lowest possible resistance* through the circuit, even to the furnishing of the river cables with conductors weighing 500 lbs. per mile.

Ground wires were placed on every tenth pole.

When the first 100 miles of wire had been strung, I was much encouraged to find that we could telegraph without any difficulty past the average provincial "ground," provided the terminal grounds were good.

When the western end of this remarkable wire reached Olean, N. Y., 400 miles from New York, my assistant, Mr. S. K. Dingle, proceeded to that town with a receiving instrument, and we made the first test.

I found that 800 words, or 20,000 impulses per minute, could be transmitted in Morse characters over that circuit *without compensation* for static.

In other words, the old Bain method was competent to telegraph 800 words per minute on the 400 miles of 1.5 ohm wire.

The trouble began, however, when the wire reached Cleveland, O., about 700 miles from New York.

Upon making a test at Cleveland, I found the signals made a continuous black line upon the chemical paper. I then placed both ends of the wire to earth through 3,000 ohms resistance, and introduced a small auxiliary battery between the chemical paper and earth.

The auxiliary or opposing battery was placed in the same circuit with the transmitting battery, and the currents which were transmitted from the latter through the receiving instrument, reached the earth by passing directly through the opposing battery.

The circuit of the opposing battery was permanently completed, independently of the transmitting apparatus, through both branch conductors and artificial resistances.

The auxiliary battery at the receiving station normally maintained upon the main line a continuous electric current of a negative polarity, which did not produce a mark upon the chemical paper.

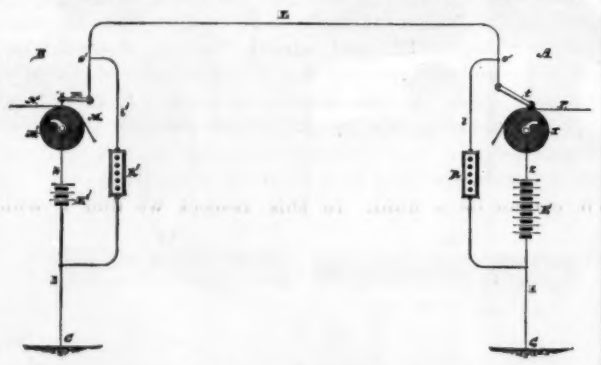
When the transmitting battery was applied thereto, the excessive electro-motive force of the latter overpowered the current from the auxiliary battery and exerted, by means of a positive current, an electro-chemical action upon the chemical receiving paper, producing a mark.

Immediately upon the interruption of the circuit of the transmitting battery, the unopposed current from the auxiliary battery at the receiving station flowed back through the paper and into the main line, thereby both neutralizing the residual or inductive current, which tended to flow through the receiving instrument, and serving to clear the main line from electro-static charge.

The following diagram illustrates my method:

Referring to this diagram, A and B respectively represent a transmitting and a receiving station of an automatic telegraph. These stations are united in the usual manner by a main line L. At the transmitting station A is placed a transmitting battery E, having its positive pole connected by a conductor 2 with the metallic transmitting drum T. The negative pole of the battery E is connected with the earth at G, by a conductor 1. A metallic transmitting stylus t rests upon the surface of the drum T, and any well-known or suitable mechanism may be employed for causing an automatic transmitting pattern slip P to pass between the stylus and the drum. The transmitting or pattern slip P is perforated with groups of apertures of varying lengths and intervals as required to represent the dispatch which it is desired to transmit, by an arbitrary system of signs, such, for example, as the Morse telegraphic code.

At the receiving station B is placed a recording apparatus M of any suitable or well-known construction. A strip of chemically prepared paper N is caused to pass rapidly and uniformly between the drum M^1 and the stylus m of this instrument in a well-known manner. The drum M^1 is connected with the earth by conductors 4 and 3, between which is placed the auxiliary battery E, the positive or marking pole of this battery being connected with the drum and the negative pole with the earth. The electro-motive



force of the battery E^1 is preferably made about one-third as great as that of the battery E.

Extending from a point o in the main line, near the transmitting station, to the earth at G, is a branch conductor l, containing an adjustable artificial resistance R. A similar conductor ll extends from a point o^1, near the receiving terminal of the line L, to the conductor 3, in which an artificial resistance R^1 is also included, this resistance being preferably approximately equal to the resistance R. The proportions of the resistance of the main line and the artificial resistances which I prefer to employ may be approximately indicated as follows: Assuming the resistance of the main line to be 900 ohms, the resistance R and R^1 should be each about 3,000 ohms. The main battery E should then comprise about 90 cells and the auxiliary battery E^1 30 cells.

The operation of my improved system is as follows: While the apparatus is at rest a constant current from the battery E^1 traverses the line L and the branch conductors l and ll, dividing itself between them, in inverse proportion to their respective resistances, in accordance with the well-known law of Ohm. When the transmitting pattern strip P is caused to pass between the roller T and the stylus t, electric impulses will be transmitted upon the line L from the positive pole of the battery E, which will traverse the main line L, the two branch lines l and ll and their included resistances, and also the receiving instrument M. The greater portion of this current will, however, on account of the less resistance offered, traverse the receiving instrument M and the auxiliary battery E^1. The current from the last-named battery will thus be neutralized and overpowered, and the excess of current from the main battery E will act upon the chemically prepared paper and record in the form of dots and dashes or like arbitrary characters the impulses which are transmitted.

Immediately on the cessation of each impulse, the auxiliary battery E^1 again acts to send an impulse of positive polarity through the receiving paper and stylus in the reverse direction and through the line L, which returns to the negative pole of the battery by way of the artificial resistances R and R^1. Such an impulse, following immediately upon the interruption of the circuit of the transmitting battery, acts to destroy the effect of the "tailing" or static discharge of the line L upon the receiving instrument, and also to neutralize the same throughout the line. By thus opposing the discharge of the line by a reverse current transmitted directly through the chemical paper, a sharply defined record will in all cases be obtained; and by transmitting the opposing impulse through the line, the latter will be placed in a condition to receive the next succeeding impulse and to record the same as a sharply defined character.

This arrangement was made on the New York-Cleveland circuit, and the characters were then clearly defined and of uniform distinctness. The speed of transmission on this circuit was from 1,000 to 2,000 words per minute.

Upon the completion of the wire to Chicago, total distance 1,050 miles, including 6 miles of No. 8 iron wire through the city, the maximum speed was found to be 1,200 words per minute, and to my surprise the speed was not affected by the substitution of an underground conductor for the overhead wire.

The underground conductor was a No. 16 copper wire weighing 67 pounds per mile, in a Patterson cable laid through an iron pipe.

I used 150 cells of large Fuller battery on the New York-Chicago circuit, and afterwards with 200 cells in first class condition, transmitted 1,500 words, or 37,000 impulses per minute, from 49 Broadway, New York, to our test office at Thirty-ninth street, Chicago.

The matter was always carefully counted and the utmost care taken to obtain correct figures.

It may be mentioned as a curious fact that we not only send 1,200 words per minute through 1,050 miles of overhead wire and 5 miles of underground cable, but also through a second conductor in No. 2 cable back to Thirty-ninth street, and then connected to a third underground conductor in No. 1 cable back to Chicago main office, in all about 15 miles of underground through which we sent 1,200 words per minute and had a splendid margin.

The International Electrical Exhibition.

At a special meeting of the Electrical Section of the Franklin Institute, held at the end of March to consider in what way the Section could best aid in promoting the International Electrical Exhibition, resolutions were adopted requesting the members of the Section to indicate to its President the branches of electrical science with which they were most familiar, and in which they could be of most service in securing exhibits; and authorizing the President to appoint as many committees as he thought advisable, whose duty it should be, by individual action, to induce inventors and others to exhibit their instruments and devices.

The committees have been appointed, and are now at work in their respective classes and localities. As the matter is of general interest, we give the names of the committees:

SEC. 1. Classes 1, 2 and 3—Production of Electricity: Apparatus for electricity of high electromotive force, Voltaic electric apparatus, thermo-electric apparatus. Messrs. A. E. Outerbridge (chairman), H. W. Sellers, D. S. Holman, Geo. H. Perkins.

SEC. 1. Classes 5 and 6. Dynamo-electric apparatus; mechanical motors—steam, gas, water, heat and wind engines. Messrs. W. W. Griscom (chairman), N. H. Edgerton, R. B. Haines.

SEC. 2. Electro Conductors. Class 5. Sub-marine cables. Messrs. W. J. Phillips (chairman), David Brooks, A. B. Burk.

SEC. 3. Measurements. Messrs. John W. Nystrom (chairman), Murray Bacon, A. F. Fleischmann.

SEC. 4. A. Apparatus requiring electric currents of comparatively low power. Messrs. Murray Bacon (chairman), L. H. Spellier, A. F. Fleischmann.

SEC. 4. B. Apparatus requiring electric currents of comparatively great power. Messrs. A. B. Burk (chairman), N. H. Edgerton, W. W. Griscom, A. E. Outerbridge, John Weaver.

These gentlemen have met with the greatest encouragement in their work, as the applications for space have been very numerous already. It is stated that Section 4, B, promises to make a very conspicuous display, embracing, as it does, electric light, storage batteries, and electric motors. Mr. L. H. Spellier can always be found at 31 Astor House, this city, and he will be glad to furnish application blanks or any other information desired.

THE CUMMER ENGINE CO.'S ACTIVITY.—The Cummer Engine Co., of Cleveland, O., have just shipped one of their "Ballantine" ice and refrigerating machines to Albert Ziegele & Co., Buffalo, N. Y., and expect to be able to ship three more of these machines, of large size, within the next two weeks. Among some of the Cummer Engine Co.'s more recent shipments of engines are an 89 h. p., to Wright & Baker, Minneapolis, Minn., and one of 414 h. p., to the Paine Lumber Co., Oshkosh, Wis. They have recently received orders for the following engines: A 55 h. p., for Porter & Worrell, Cisco, Tex.; one of 67 h. p., for Stults & Kile, Orwell, O.; a 55 h. p. complete outfit for the Fort Wayne-Jenny El. Lt. Co., Fort Wayne, Ind.; a 105 h. p. engine for Lorin Mitchell, Wausau, Wis.; 75 h. p. outfit complete for Cheesman & Dreisbach, Reno., Kan.; and a 137 h. p. engine for A. L. Johnson & Co., Muncie, Ind. The Cummer Engine Co., have added two 5′ lathes and a large steam hammer to their fine line of first-class tools, and have placed their order for a boring mill with a capacity to turn a pulley 20′ dia. × 5′ face. This will probably be the largest machine of the kind in the Western States. The Cummer Engine Works, with this added machinery, coupled with increased facilities for handling, will be one of the most complete and best-equipped shops in this country for automatic engine building.

Electrical Information for Beginners.

BY WM. MAVER, JR.—PART V.

Electricity and Magnetism.

Magnetism differs from electricity in that it cannot be generated or developed like the latter, in all bodies promiscuously. We have seen that glass and iron may be easily electrified by friction. This is also true of wax, resin, paper and all the other solids, when proper means are employed. On the other hand, iron or compounds of iron are the only substances out of which we can make magnets. There are, at least, three different methods of obtaining magnets, namely, in the natural magnet, or lodestone, which is found in various parts of the world; the artificial magnet, which is obtained by rubbing a piece of iron or steelwith a magnet, and by the magnetism which is

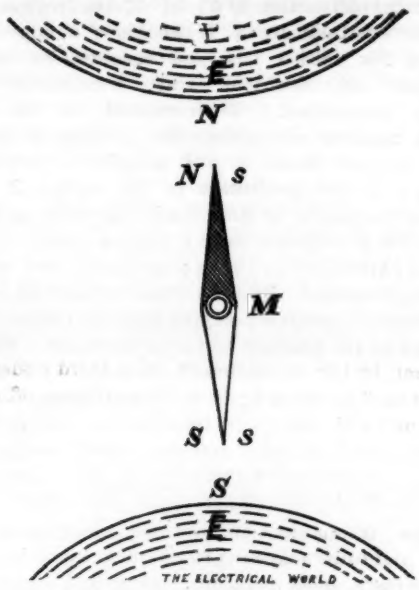


FIG. 8.

generated in iron by the passage of a current of electricity in a coil of wire wound around the said iron.

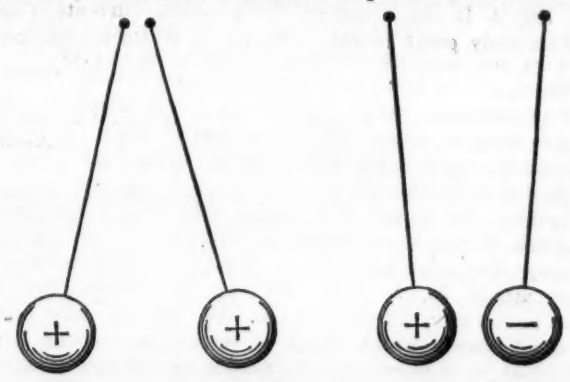
It is also possible to magnetize a piece of iron by sticking it in the ground, with one of its ends inclined to the north and the other to the south. The magnetism produced in this way will be more pronounced if, while the iron is in the above position, it be struck sharply on the upper end with a hammer or mallet.

If we suspend a magnet so that it is free to move, it will invariably point north and south. The end of the magnet that points to the north has long been called the north pole, and the end that points to the south the south pole of the magnet. But of late years this custom has been very generally discontinued among scientists.

The reason for this is explained as follows: If we take a magnet and present the end of it which points to the north, to that end of another magnet which also points to the north, it will be found that these poles repel each other. It will also be found that if we take the pole of a magnet that points to the south and approach it to that end of any other magnet which points to the south, these poles will also repel each other.

On the other hand, if we present that pole of a magnet which points to the north to that end of another magnet which points to the south, these poles will attract each other.

Now it has been established that the earth itself is a great magnet, having all the characteristics of a magnet, with its north pole situated in its northern portion and its south



FIGS. 9, 10.

pole in the southern portion of the earth. When, therefore, a magnet or magnetic needle is placed so that it may move freely, one of its poles will point to the north pole of the earth and the other to the south pole of the earth. But as we know that the north pole of one magnet will repel the north pole of another magnet, while a south pole will repel a south pole, it must be evident that the pole of the magnet that points to the north pole of the earth cannot be a north pole; and if not, then it must be a south pole. On the contrary, the pole of a magnet that points to the south pole of the earth must be of opposite magnetic polarity to that pole of the earth to which it is pointing—that is, a north pole. This is illustrated in Fig. 8, in which *NE* is supposed to be the north pole of the earth and *SE* the south pole of the same. It will be seen that the so-called north pole of the magnetic needle is pointing to the north pole of the earth, while the so-called south pole is pointing to the south pole of the earth. As it would be a violation of the law of magnetism that like poles repel each other and unlike poles attract each other, it cannot be that similar poles are pointing to each other, as this would indicate. It is, therefore, the south pole of the magnet that points to the north and the north pole that points to the south. But as the habit of calling the north-pointing pole of a magnetic needle a north pole and the south-pointing pole of the same a south pole has been so long in vogue, namely, since the days of Gilbert, and as it would create much confusion to change the usage as to the names of the poles, it has been tacitly agreed to call them respectively the north-seeking pole and the south-seeking pole of the magnet.

Electricity resembles magnetism in respect to this attraction and repulsion of the poles. For instance, if we charge two light bodies, such as those shown in Fig. 9, with positive electricity, they will repel each other, as shown, while if we charge two similar light bodies one with positive and the other with negative electricity, they will attract each other, as shown in Fig. 10.

We come now to consider, more particularly, a feature of electricity which is also common to magnetism. This feature is known as induction.

It is well known that a magnet will sustain a piece of non-magnetized iron. It is frequently seen in the ordinary horse-shoe magnet, which attracts and sustains the piece of iron termed the "keeper" across its poles.

If, as in Fig. 11, we take a magnet *M* and approach its north pole to a piece of iron *M'* we will find, on applying some tacks or nails to one end of *M'*, that it now manifests the same qualities of attraction as the regular magnet *M*. In other words, the magnet *M* has *induced* magnetism in the iron *M'*; and we would further find, on examination, that the magnetism induced in the end of *M'* nearest *M* was of south polarity, while the distant end of *M'* was of north polarity. If we should cause the ends of *M* and *M'* to *touch* each other, the magnetism in *M'* would be intensified; but on withdrawing *M'* from *M* entirely, the former would lose its magnetism and the tacks on it would at once fall off.

If, however, we should draw the north pole of *M* over the surface of *M'*, from end to end, several times, we would then find that *M'* had also became a magnet, with probably as great a magnetic force or strength as the magnetizing magnet *M*; and, strange to say, *M* would not show by an ordinary test that it had lost any of its original magnetism. In fact, many magnets may be made from one original magnet without the latter showing any appreciable decrease of magnetic strength. This would appear to be conclusive proof that whatever magnetism may be, it cannot be a fluid. In this respect we find a wide

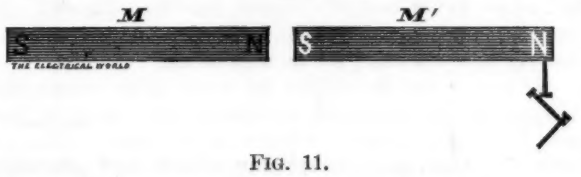


FIG. 11.

disparity between electricity and magnetism.

Suppose that we charge the insulated metal cup shown in Fig. 12 with positive electricity. We shall find that when we approach the thimble, which is suspended by a silken thread from the fingers, toward the cup, that the thimble is attracted to it, and it could be readily shown by means of an instrument called the galvanoscope, that electricity was now induced in the thimble. A galvanoscope is constructed on the principle that like kinds of electricity repel each other, and generally consists of a piece of gold leaf suspended within a glass case, Fig. 13, in such a manner that equal portions of the leaf hang close to each other, in the same way, for instance, to use a very homely simile, as the ends of a coat meet when thrown over one's arm. The action is very simple. When the leaf becomes electrified from such a source as the above, it must necessarily be with one kind of electricity, and thus the ends of the leaf tend to stand out from each other as in Fig. 14. The distance to which the ends of the leaf will separate will depend on the amount of electricity with which the leaf has been charged.

The same result, produced by the same cause, may be prettily shown by the following simple experiment: Take a sheet of paper, and after placing it on a smooth surface, rub it briskly with a piece of rubber. This electrifies the paper with one kind of electricity. Then, with a sharp knife, quickly cut the paper into narrow strips, beginning to cut about an inch from the end of the paper. On lifting the paper by the uncut end, each strip will bristle away from its neighbor.

Now, if before bringing the thimble up to the cup, we had connected the former by means of a wire to a galvanoscope, when we approached the thimble to the cup, a divergence of the ends of the leaf of the galvanoscope would show that the thimble was now electrified and the closer we should approach the thimble to the cup, the greater the divergency would be.

We would also observe on approaching the thimble to the cup, that the thimble is attracted toward the cup, which is due to the fact that the plus electricity with which the cup is charged has attracted the inherent negative electricity of the thimble to that side of the thimble nearest the cup and has repelled the inherent positive electricity to the remote side of the thimble. The effort of the positive and the negative electricity to unite has the effect of drawing the lighter body to the heavier. The leaf of the galvanoscope is thus charged with the repelled or positive electricity of the thimble.

The electricity thus produced in the thimble is called induced electricity. In other words, we have electrified the thimble by induction. If in like manner we had connected the cup to a galvanoscope, we would find on causing the thimble to *touch* the cup that the leaf of the galvanoscope attached to the cup had slightly fallen, owing to the fact that the latter had imparted to the

FIG. 12.

thimble a portion of its electricity; and the amount of electricity thus imparted to the thimble would be in exact proportion to the respective capacity of the two articles. Just as we would find, if we should fill the cup with water, and from the cup fill the thimble, that the quantity of water now remaining in the cup lacked the amount necessary to fill the thimble.

This action of electricity is invariable. If we had touched the charged cup shown in the figure with a cup of equal size—that is equal capacity—the electricity in the former would have divided itself equally between the two cups.

We would further find when we have allowed the thimble and cup to touch, that they now repel each other, owing to the fact that both are now charged with a surplus of positive Electricity.

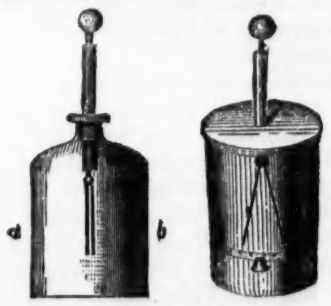
(TO BE CONTINUED.)

Underground Wires in Washington.

The Chesapeake & Potomac Telephone Co. have just completed laying an underground conduit half a mile long, for the purpose of making a practical test of underground wires for telephone purposes.

A ditch 18 × 18 inches was made in the side walk, in which a board trough 8 × 8 inches was placed.

This trough contains in all about 500 wires. Three Phillips and three Patterson cables are laid in the bottom. Fifty No. 18 office wires—some of them bare—are above



FIGS. 13, 14.

the cables and ten No. 8 electric light wires above these.

The trough is filled with asphaltum, which was poured in while hot, surrounding the wires and cables and forming a solid mass. This is quite an expensive test, as it will cost the telephone company nearly thirty thousand dollars, although it may prove cheap to them in the end. The wires in the cables have been tested since being put down, and are reported to be in first-class working order.

The cables are guaranteed to work for eighteen months. The Patterson cables mentioned are like the one laid in the Mississippi from St. Paul to New Orleans, which has been doing such good service.

The work was done by the Western Electric Mfg. Co. of Chicago, and superintended by Mr. R. H. Widdicombe.

THE

ELECTRICAL WORLD,

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Mr. Mailloux's articles are marked thus: *,*. Mr. Keith's thus: □. The Department of Inquiries and Our Illustrated Record of Electrical Patents are edited by Mr. Keith.

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TELEGRAPHIC NEWS.

Few readers of the newspapers ever pause as they turn the pages to reflect on the vast proportion of telegraphic news in them. And yet the part played by the telegraph in the transmission of news is one of the most important features of modern journalism. Not only the large urban papers, but small provincial ones, publish daily several columns of wired news, and the tendency now on the part of journals that can bear the expense is to lease special wires.

It always takes an unusual occurrence to draw attention to facts that would have been noticeable were it not that they had insensibly become matters of course to the public. In this manner the Wall street panic of last week has directed attention to the wonderful facilities now provided and enjoyed for furnishing the people of the whole country with the latest telegraphic intelligence, through the medium of the press. It is safe to say that no event has ever been more thoroughly "covered" by the press throughout the United States than the brief panic, not even the assassination of President Garfield.

A few inquiries develop some very interesting facts in regard to the work now being done in the telegraphic transmission of news, by press associations and individual papers. The Associated Press was very busy during all last week, as might be expected, and the total of words sent and received was enormous. On each of the busy days, when excitement was at its height, the Associated Press supplied to the Western Associated Press, on an average, 35,000 words; to the Southern wire and points, 45,000; New England Press, 35,000; State Press, 20,000; Canadian, 12,000. The cable and general matter not included in the above amounted to 8,000 words, making 155,000 in all. But the above list includes points for subdistributing, and the ramifications all over the country, taking in all the small places supplied from Philadelphia or Cincinnati, or any other large city, would increase this press business at least fourfold, and bring the quantity up to at least 600,000 words of news then supplied daily by the Associated Press organization to its different circuits. This is a prodigious total, but the authorities say it is, if anything, an under-estimate. From all we can learn, the work was done most thoroughly and satisfactorily.

The United Press is making a splendid record for itself, and already does an immense business for about 200 papers Mr. W. P. Phillips, the energetic manager of this organization, states that he has a Baltimore & Ohio night wire from New York to Louisville *via* Philadelphia, Baltimore, Washington, Pittsburgh, Columbus, Cincinnati and Chicago; Bankers & Merchants' day wires to Boston, Buffalo and Pittsburgh *via* intervening points; Bankers & Merchants' night wires to Boston and Buffalo; and leased Western Union wires. He supplies at least 7,000 words on the average during the day, and about 10,000 at night, although these figures are far exceeded during seasons of excitement such as Wall street panics. The cable news furnished by the United is received through the medium of the Central News agency. It is claimed that last week three quarters of a column would be supplied to all the United Press papers out of town before a line on the same subjects had been printed in New York. We may say here, it is noticeable of some out of-town reports of the New York financial flurry, that they are even more extensive than those which appeared in New York papers, and gave many details not reported locally. It is quite evident that the large papers outside New York are more liberal and enterprising than the metropolitan papers. Besides supplying its own clients, the United Press turns its matter over to the American Press Association, a stereotype-plate concern, representing 300 newspapers, published in places of the size of Ansonia, Conn., New Brunswick, N. J., or North Attleboro', Mass. The plates made up and supplied to these papers are supplemented by telegraphic dispatches to the extent of 250 words a day, and thus for, say $25 a week, a country paper can give its readers daily the latest news in a bright, readable style, at great length. The United Press and the American Press Association have their hands full, and we understand that the system of the latter is about to be considerably expanded.

The statistics above do not exhaust the subject. The Baltimore & Ohio Company now handles nightly from 25,000 to 30,000 words of special news, serving chiefly one important paper, the Chicago *Inter-Ocean*. In view of the rapid extension of this company's services, it is plain that its transmission of a very large quantity of press matter is only a question of time. The panic gave to the company a good deal of new business, and that has not been withdrawn, and the desire on the part of ambitious journals to have special wires must be of benefit to this formidable rival of the Western Union Company. If we are not mistaken, the *Inter-Ocean* has an Associated Press franchise as well.

The Postal Telegraph Company is barely ready to do business, but it has already found occupation in telegraphing news. The New York *Herald* has sole use of one of its wires between this city and Washington, and the company handles a large number of words for the St. Louis *Republican*. Altogether its press matter may be put down at about 10,000 words a night, but Mr. Emerick, the Superintendent, is of opinion that these figures will not be very near the mark six months hence.

We take it that the exhibit we have given shows that the new and old telegraph companies have a good prospect in the transmission of news for the papers. This is a campaign year, and enterprising editors and publishers will not stop for the sake of a few dollars. For instance, this week, the Chicago *News*, being in favor of President Arthur's renomination, had the business men's meeting of Tuesday evening telegraphed to it in full, and published a longer report than most of the New York papers. This was a noteworthy feat, and was well done, but it may be looked upon as only the first of many. And when people have been educated up to this taste for full telegraphic news, they will not go without it.

ELECTRICAL ENGINEERING.

Attention has recently been directed by some remarks of Dr. Werner Siemens, to the means adopted in Germany for the training of electrical engineers. A little more than two years ago, this distinguished man, at a meeting of the German Electrical Society, spoke of the great desirability of founding in all the technical colleges, professorships for electrical engineering. This timely hint was caught at eagerly by the technical colleges and polytechnic schools of Germany, and electrical study became a part of their regular course. It would appear, however, that in some respects the new departure has not been satisfactory. This year, in a speech before the same Society, Dr. Siemens has expressed himself as follows on the subject: "The impulse I then gave has in many cases been misunderstood, as if I had advocated the establishment of professorships for the purpose of educating a special class of engineers, viz., electrical engineers. There has already been a large concourse of young men to this 'new branch,' and this is to be regretted. Electrical engineering is not an independent branch of science, but simply an auxiliary to many other branches. It should be so taught as to enable the young engineer to apply it where possible to the improvement of his special branch of engineering. The manufacture of electrical machines and appliances is simply a branch of general mechanical engineering, but not an independent profession." From these remarks we gather that the electrical instruction given in Germany has been largely theoretical. We do not see in what other way electrical engineering could be considered to be an independent branch of science, as nearly all practical work has intimate connection with mechanical engineering in one form or another. Although the German electricians it has been our pleasure to meet have been able, thoroughly trained, practical men, of well-rounded information, it is possible that the new electrical professors in Germany have gone in for pure science, on the ground that telephony and electric-lighting are no more fit to be called science than cookery is to be called chemistry, and that electricity is to be something beyond the reach of civil and mechanical engineers.

In this country the new study of electricity does not lie open to the criticism directed against the German methods by Dr. Siemens. At least it does not appear upon general examination to be deficient in scope. The curriculum at Cornell is liberally comprehensive, and the man who goes through all the subjects is likely to be as much a mechanical, as he is an electrical, engineer. The same might be said of Yale and Harvard, where provision has been made for electrical instruction as a part of the regular course. At the Stevens Institute of Technology, a copy of whose catalogue for 1884-5 has just reached us, the interdependence of electrical and mechanical studies is fully recognized. With regard to the department of applied electricity, the course of the Institute is claimed to be "well adapted to prepare those pursuing it for the profession of the electrical engineer, who must manifestly be first of all a mechanical engineer, and on this foundation build a certain amount of knowledge and experience in the special theory and practice of electric applications." The reputation gained by graduates of the Institute justifies this language, and shows it to be warranted by the practice of the department. The course mapped out by the Massachusetts Institute of Technology, for four years' study, is again of a very thorough character. The second year's study includes shopwork, carpentery, wood and metal turning, and machine drawing; and the third year embraces special methods in photometry; general physics, electricity; photometry; integral calculus; applied mechanics; mechanical engineering, theory and practice of steam and other engines; mechanical laboratory, use of dynamometers, indicators, etc.; electrical measurements and testing; advanced physics, memoirs, etc.; history of physical sciences. The fourth year takes these subjects in a higher range. All of which is evidence that in this country we have not fallen into the error deprecated and condemned by Dr. Siemens, of regarding electrical engineering as an independent branch of science. The principle upon which instructors here are proceeding is that the more a man knows of the phenomena of heat, sound and light, of water, steam, air and gas as motive powers, of engines and turbines, the better electrician he will be. We notice, too, that outside the ranks of those who aim at becoming professional electrical engineers, there are a great many thoughtful men who are reading all they can put their hands on about physics and mechanics as related to electrical knowledge and applications. This is as it should be. There is not much fear that American electricians will ever be wanting in practicality, as would, from Dr. Siemens' statement, appear to be the case with their German brethren in the technical colleges and schools.

AFTER THE STORM.

To all outward seeming, the panic in Wall street has come to an end, although nothing is more likely than that all kinds of business will be dull and somewhat depressed until the fall, as a result of the recent occurrences. We remarked last week that during the panic, and before it happened, "electrics" had been very steady. Our opinion is that at the present low range of prices all the standard electrical stocks are "a purchase." The statistics we have published with regard to the electric light show that that department of the electrical business has, in spite of dull times, grown at a very rapid rate, and is already fulfilling its promise of commercial success. Bell telephone stock, now down to about 150, in sympathy with the general market, ought to find many buyers at that price, but we do not think that much of it will go at that rate into new hands. The tumble in the price of Bankers & Merchants' stock, of over 70 points, was sensational, but we note that very few sales are made. Western Union stands now at about 55, a very low figure, indeed, but not so low as that of ten days ago. We cannot quite understand why Western Union at present quotations is not looked upon as worthy of attention on the part of investors. Telegraphic business is always briskest at such times as we are now passing through. Besides, this is a campaign year, when the company may reasonably be expected to do extra work to the extent of several hundred thousand dollars. Under its new rates, the Western Union Company is doing well in spite of all opposition. The test offices showed a gain last week of $18,000, and as they do a fourth of the whole business, the total gain would reach from $60,000 to $70,000 for the week. Sober calculations taking this data, make the stock appear cheap at 55. It is said that the dividend will be reduced from 7 to 6 per cent., a rate that the present business can bear satisfactorily. We would not be surprised to see the old rate maintained.

THE AASGEIER AND THE TELEPHONE.

According to the *Brazilian Germania* of Rio de Janeiro, the telephone wires in that city have found a formidable enemy in the "Aasgeier," a large bird of the vulture

species—a kind of John Crow—which flying very low, as it passes over the tops of the houses in scavengering the streets, hits the wires and breaks them or else becomes entangled. Good wire is very expensive in Brazil. In consequence of the damage done by these birds, the telephone people are compelled to keep up a large force of men for repairs. No sooner are the wires mended in one part of the city than report comes of interruption in another part, owing to the operations of the Aasgeier. It is against the law to kill these birds, and as a result they increase very rapidly in number. The *Provinzia*, too, says that nothing positively remedial can be done at present. The telephonists must wait until the bird learns by experience that it will enjoy more personal comfort by flying higher. It would be interesting to know whether anything similar to this has been noticed in other tropical or sub-tropical towns in which telephone wires have been strung. The advocates of underground systems may feel disposed to look on these John Crows as very sensible birds, engaged in making a laudable protest against aerial electric wires.

Van Benschoten & Johnson's Electric Annunciator and Fire-Alarm.

We always hail with pleasure any improvement which seems to add to the convenience, comfort and safety of mankind; and especially so when the benefits are wrought out by electricity and the electrician's art. This apparatus named above is of special use in hotels; though our large compartment houses, industrial establishments, and even our private houses may be improved in the way of safety by its use.

The present generation has had but little experience in the old hotel with no means of calling assistance from the office except by going for it, because bell cranks or pulls have been in common use for many years, though more often than otherwise useless from breakage or slackness of wire. Even now it is only in the modern hotels that the electric annunciator is in use. But even this has its defects, the most prominent of which, setting aside the occasional periods of being "out of order," is the lack of any means

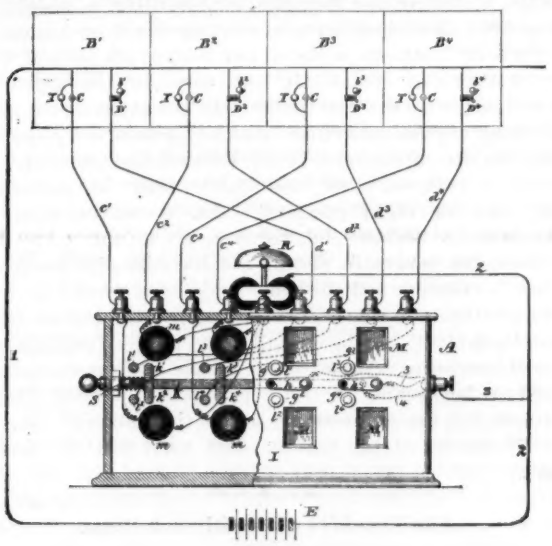


FIG. 1.

of notifying the guest that his call has been heard and will receive attention, until, perhaps, after the lapse of many minutes he presses the button again just as the attendant knocks at the door, if he comes at all. How much better is it, then, to have the means at hand to enable the clerk at the office to signal back by the mere motion of the hand that the signal has been received and will be noticed. This adds to the convenience of both guest and host.

Furthermore, under present arrangement of hotel and nunciators and connections, when a caller on a guest asks at the office whether the guest is within the hotel, no means is provided whereby the clerk can tell whether the guest is in his room except by sending a hall-boy to inquire. In our immense hotels this procedure takes much valuable time in waiting, and extra expense for hall-boys. By the system under consideration the presence of the guest in his room may be determined in a moment at any time.

Another convenience, or rather measure of safety, for the guest, is the means provided, under this system, of ringing in any or all of the rooms simultaneously an alarm, such as for fire, so that all may receive an alarm instantaneously and unmistakably. Still another element of safety is provided by the means employed for automatically closing an electric circuit to ring an alarm at the office to announce the presence of fire or undue heat in any room, whether occupied or not.

We have prepared some diagrams and cuts to illustrate this system, the particulars of which have been furnished to us by Mr. H. H. Johnson, of Hackensack, N. J., the inventor of the electrical arrangements of the improvements we here describe.

In Fig. 1 *A* represents an annunciator case at the hotel office, with a portion of the front removed to show the internal arrangements. *M M* represent the drops whereat the signal numbers of the rooms are displayed whenever the proper connections are made. The electro-magnets which control the drops are represented by *m m*. *R* is the usual annunciator bell, with its electro-magnet common to all the circuits, and B^1 B^2 B^3 are to represent the rooms. In each of these rooms are a push-button circuit closer *C*, a thermic circuit maker *T*, and an electric vibrating bell *D*. As the circuits for each room are the same as for all the others we may consider any one in order to understand the operation of the system.

If the occupant of room *B'* presses his push-button *C*, electric current will flow from the battery *E* through wire 1 by the course *C c'*, binding-post and drop-electro-magnet *m* (where the drop exposes the number of the room), to the magnet of bell *R* (where the signal is rung), and then back to the battery by the wire 2. The clerk at the office then

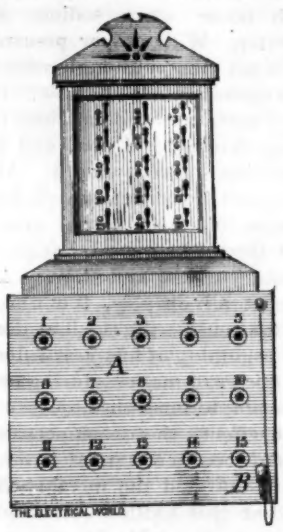


FIG. 2.

moves the appropriate switch-handle as at *h* on the face of the annunciator so that it touches a knob *g'*, which is connected with the pin *l'*. This movement closes a circuit so that electric current flows from the battery through the course by wire 1, bell *D'* (which then rings), wire *d'*, binding-post, pin *l'*, knob *g'*, handle *h*, dotted line wire 3, binding-post, wires 3 and 2 to battery. This operation notifies the guest that his call has been noticed.

If it is desired to know whether the guest is in his room, the clerk moves the switch-handle as described, and the guest, if present, answers by pressing the button *C*. A printed, simple code of signals may be arranged and posted at the push-button.

If a fire breaks out in the room during the absence or

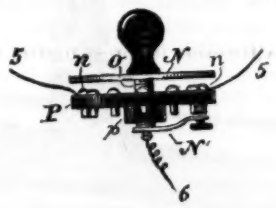


FIG. 3.

sleep of the guest, the heat imparted to the thermic circuit-maker closes the circuit around the push-button, and a current flows in a circuit otherwise like that first considered, with a like, though prolonged, ringing of the bell *R*. The thermic circuit-maker may be of any approved kind, and be located in any part of the room, preferably on or near the ceiling; only it must be in a shunt around the push-button.

In case of a general alarm for fire, the clerk pulls the knob *S* outward, and with it the attached bar *K* and the cross-pieces k^1 k^2 k^3 k^4, so that the last come in contact with the pins l^1 l^2 l^3 l^4. The current from the battery then flows in parallel or multiple-arc through the bells in the several rooms, and the wires d^1 d^2 d^3 d^4, pins l^1 l^2 l^3 l^4, bars k^1 k^2 k^3 k^4, bar *K*, wires 4, 3, and 2, to the battery. The bells are rung, as is set forth in Mr. Tompkins' letter printed in our issue of May 3d, and in the letters thereon printed in our issue of May 17th last.

It is obvious that various kinds of annunciators, and also that various circuit-makers, may be used. One form of annunciator with a return-signal board *A*, is shown in Fig. 2. By inserting the plug *B* in the appropriately numbered hole, 1, 2, 3, etc., the proper circuit is completed

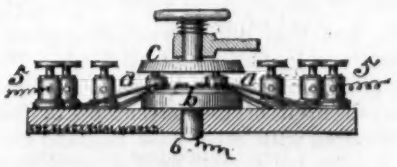


FIG. 4,

and the bell rung in response, or for call. The electrical connecting wires are not shown, because their arrangement is obvious. Fig. 3 shows one arrangement to take the place of knob *S* and bar *K*, by which the general alarm may be rung. The disc *N* may be pressed down into contact with the buttons *n n*, which are connected with the wires, 5, from the several rooms, one to each, and then the currents join to flow to battery through wire 6. A better arrangement for this purpose is shown in section by Fig. 4, and in plan by Fig. 5. The currents then come in by lines 5 5, and flow through springs *a a*, to disc *b* and wire 6, whenever the disc is pressed downward to bring the under surfaces of the springs into contact with the disc *b*. □

Magnetic Polarity and Neutrality.*

BY PROFESSOR D. E. HUGHES, F.R.S.

In recent papers upon the Theory of Magnetism, I gave the opinion, drawn from a long series of personal researches, that magnetism in iron and steel is entirely due to the inherent polarity of its molecules, the force of which could neither be destroyed nor augmented, and that when we have evident magnetism the molecules rotate so as to have all their similar polarities in one direction. This opinion has long been held and demonstrated by the researches of Page, Marianini, Wertheim, Matteucci, De la Rive, Weber, Du Moncel, Wiedemann, Beetz, and Maxwell. The united demonstrations and reasonings of these *savants* leave but little doubt upon the minds of those acquainted with these researches that this view of the cause of evident magnetism is demonstrable, and no longer in the domain of assumption.

They, however, having no experimental data, adopted a theory of neutrality resting entirely upon hypothesis, and drawn from the ancient theory of magnetic fluids, where neutrality in iron was supposed to be the result of an intimate mixing of the two magnetic fluids. Coulomb, while accepting the molecular nature of magnetism, holds that the magnetic fluids are mixed in the molecule itself when neutral. Ampère assumes that the polarity is due to a circulating electric current; he assumes also that after these currents have become symmetrical when polarity is evident, they become heterogeneous when the iron returns to an external neutral state. De la Rive, Weber, Wiedemann, etc., have all adopted this assumption of heterogeneous neutrality; but it fails to explain why a neutral piece of iron is easily disturbed by external polarizing forces, showing at first an apparent desire for external polarity, at the same time resisting this force, returning as with a spring towards neutrality, which it previously was ready to leave. There were in addition so many anomalies that I felt it necessary to make a series of researches upon the true nature of neutrality, the results of which I formulated in my theory of magnetism, viz., "that neutrality was a symmetrical arrangement or a balancing of polar forces, as in a closed circuit of mutual attractions." The series of researches which I now present bear unmistakable testimony to the truth of these views, showing the waves

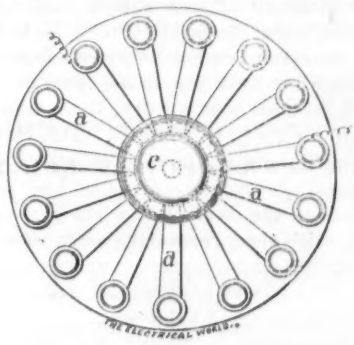


FIG. 5.

of opposite polarities which occur in iron, and that a symmetrical balancing of polar forces produces neutrality after each cessation of external polarity.

The instrument used for measurement† consists of a delicate silk fibre, suspended magnetic needle, always brought to its zero-mark by the influence of a large magnet at a distance, the angle of which gives the degree of force required to balance any magnetized body placed on the opposite side of the needle. It can also employ electro-magnetic effects by the use of two opposing coils on each side of the needle, balanced so that an electric current passing through the coils has no influence on the needle, except when a piece of iron or steel is placed inside one of the coils; this again being balanced and measured by the large revolving magnet.

Before commencing my researches upon neutrality, I felt that it was necessary to observe the curves of magnetic penetration, whilst under the influence of its inducing cause. It is well known, however, from the researches of Gaugain, Du Moncel, and Jamin, that the magnetism does not penetrate to a very great depth with its full force, decreasing rapidly from the exterior to the interior. Most observations have been made by means of tubes of various thickness, introduced into each other. These, however, introduce an element of error, as in separating them they are necessarily drawn over each other. Jamin's method of dissolving the exterior of a steel magnet in diluted sulphuric acid gave results free from experimental error, but this could only be employed after the cessation of the inducing cause, the observations being really upon the permanent remaining magnetism.

The methods employed by myself consisted, first, in superposing twenty flat iron strips, ½ millim. thick, 20 centims. long, and 3 centims. in width. These could be built up into a solid rod 1 centim. total thickness. Each piece was carefully selected and measured for its magnetic capacity, so that they should all be equal in value whilst under the influence of an inducing force, as well as their remaining magnetism when the influence ceased, the remaining magnetism being about a quarter of its capacity in the size and kind of iron employed.

*A paper read before the Royal Society, March 6th, 1884.

†"On a Magnetic Balance, and Researches made Therewith," by Professor D. E. Hughes *Proc. Roy. Soc.*, 1883.

These strips forming a compound bar were placed in contact with the poles of a strong permanent magnet, or they could be laid on one pole, the object being to polarize the lower bar only by contact, and observe the degree of penetration. The upper strip was carefully separated whilst the remainder was left under the polarizing influence. We could thus separate each bar while under the influence without fear of reactions taking place between the separated bar and its companions. We had thus a bar or strip, separated while under the inducing influence, and, knowing its coefficient of remaining magnetism, we could estimate its full power when under the polarizing influence. By this means the values were plotted graphically, giving curves of varying degrees, as the inducing force was changed, or the material of the strip from soft iron to hard steel. These curves were verified by a somewhat similar method, using a separate strip whose coefficient of remaining magnetism was known, and drawing this over the poles of a magnet, but separated from it by different degrees of thickness of iron.

These again were verified by an electro-magnetic method, in which a series of concentric tubes divided lengthwise was employed, so as to allow separation without friction, confirming the numerous curves obtained by the previous methods, showing that with a limited magnetizing power acting upon homogeneous iron or steel, the penetration is inversely as the square of the distance from the inducing power, but with high powers the exterior soon arrives at its saturation, the distant layers rise in value, and also if the bar is not homogeneous there is a consequent deformation, owing to the comparative rigidity of its molecules.

In all cases, whatever the force employed, or nature of the iron or steel, there are no reversals of polarity in the interior, but a constant diminishing curve of penetration from the outside to the centre. This changes, however, the instant the exterior polarizing force ceases, the different degrees of force between the external and internal re-act upon each other, producing the following results :

(TO BE CONTINUED.)

Electrical Units.

The Congress on Electrical Units, assembled in Paris this month, has decided unanimously that the length of a column of mercury of one square millimetre section, which shall represent the legal "ohm" shall be "106 centimetres." This, says the London *Electrical Review*, makes the British Association unit now in use .9887 of the new ohm. Thus, the legal ohm now is 1.0114 B. A. units. It is not the true ohm, or 10^9 C. G. S. units. This can scarcely be attained experimentally, but the number accepted is the mean of several observations made by the most eminent experimenters of the day. Below are given different values of units, with their respective authorities:

YEAR.	Authority.	Value of mercury unit. Ohms.	Value of B.A. unit. Ohms.	10^9 C.G.S. units in length of column of mercury at 0° C. 10 mm. section.
1865..	British Association.	0.9537	1.0000	104.83
1866..	Joule....	0.9411	0.9869	106.23
1873..	Lorenz.....	0.9337	0.9791	107.10
1874..	F. Kohlrausch... ..	0.9442	0.9901	105.91
1877..	H. F. Weber.....	0 9545	1.0009	104.76
1877..	H. F. Weber	0.9554	1 0018	104.67
1878..	Rowland	0.9452	0.9911	105.79
1881..	Rayleigh and Schuster	0.9434	0.9893	106.00
1882..	Doru....	0.9482	0.9943	105.46
1882..	H. F. Weber	0.9419	0.9877	106.16
1882..	Glazebrook and Sargeant	0.9406	0.9863	106.29
1882..	Rayleigh	0.9408	0.9865	106.27
1883..	Rayleigh and Sidgwick.....	0.9410	0.9868	106.214
1883..	Wild.....	0.94597	.....	105.711
1883..	Wild.....	0.94627	0.9922	105 678
1884..	Mascart.....	0.9405	0.9861	106.33
1884..	Wiedemann.....	0.9417	0.9875	106.19
1884..	Lorenz	0.9417	.....	106.19
1884..	Roite	.....	.....	105.90

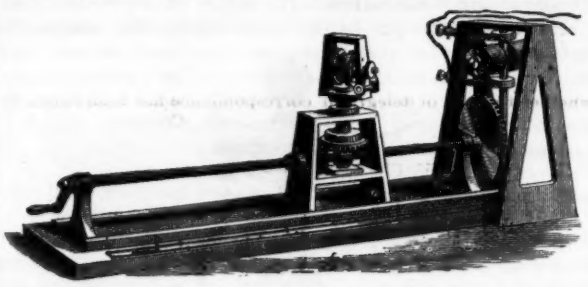
The Jablochkoff Sodium Battery.

It was announced recently in Paris that a syndicate, with a capital of $60,000, had been formed there with the object of working the sodium battery invented by P. Jablochkoff. In designing this battery, says our English contemporary, *Engineering*, M. Jablochkoff's object was to obtain an element having a much higher electromotive force than any other hitherto devised, and for this purpose he has made use of pure sodium. This metal is used in thin plates, and is coupled with compressed carbon, such as is employed in other batteries, or the plates may be placed in a metal capsule, in the midst of broken carbon. Under such conditions, subjected only to the humidity of the air, the battery yields the relatively high electromotive force of four volts, which may be raised to six volts by impregnating the carbon with certain metalloid solutions. This latter fact, however, has no practical value, because the price of such solutions, and the difficulty of using them, makes the arrangement quite impracticable. With a couple of sodium and copper, the electromotive force falls to three volts. Such a battery, which may be of value in some cases, is made up of a thin plate of sodium and a piece of red copper gauze. It will be seen that the force of this battery is considerably in excess of others now in use. On account of the avidity with which sodium decomposes water and absorbs oxygen, it is necessary to shield the battery from exposure when it is not in use, and for this reason it should be kept, except when active, in a bath of naphtha, or at all events in a hermetically sealed vessel. M. Jablochkoff asserts that the waste of the sodium, that is to say, its combustion, beyond what is converted into useful energy, is extremely small. One of the objections which naturally present themselves to this battery, is the great precaution which must be taken in using it, on account of the explosions which occur when sodium is brought into contact with water. With proper precautions, however, such a danger is not great, although more than one serious accident has happened from this cause. If, therefore, the new Jablochkoff battery ever comes into use, it would be necessary to keep it in a closed box, and to take extreme care in manipulating and renewing it. Another objection lies in the high price of sodium, which finds only a very limited application in the industrial arts. Less than a year ago it cost about $2 a pound, but since then the price has fallen to between $1.25 and $1.50. At this figure, if the battery be at all durable, the cost of each element would not be high considering the low density (.97) of the metal. At the beginning of last year Jablochkoff obtained a patent for a process of manufacturing sodium, by which he expects to be able to meet the objection of the cost. In this process he effects the decomposition by means of a current of salts of soda in a state of fusion, the resulting gases being carried off and the metal sheltered from their action. Whether this sodium battery has before it any useful future or not, M. Jablochkoff's investigation, and the results he has attained in this direction, will be found of interest by electricians.

Demagnetizing Watches.

In our Department of Inquiries, a reply was given last week with regard to the demagnetization of permanent magnets, and of watches. We then promised more on the latter subject, and we publish now an illustration of Mr. Hiram S. Maxim's machine for demagnetizing watches. It has been in use some little time, and Mr. Maxim says that it is most satisfactory. The method of working it is as follows :

The watch is put in a small clamp and a crank is turned



for one minute, when the watch has every trace of magnetism removed from it.

The machine operates on the following principle: A powerful electro bar magnet is rotated upon a vertical spindle. The watch is at first placed very near to the poles of this magnet, and the crank is turned. The turning of the crank draws the watch away from the magnet a quarter of an inch at each turn, and at the same time rotates the watch on both a vertical and a horizontal axis. In fact, the demagnetization is effected by changing the magnetic condition of the watch rapidly, and lessening it at each change until it disappears completely. The cost of such a machine is two hundred and twenty-five dollars.

The Telephone in New England.

The report of the directors of the New England Telephone & Telegraph Co. for the six months ending March 31 appears in print. The financial statement was published in our issue of May 10. From the printed document, it is learned that there were 109 exchanges in operation March 31, connecting 472 towns and villages. The number of exchange subscribers connected Oct. 1, 1883, was 16,533; April 1, 1884, 17,826, a gain of 1,293, or a fraction over 215 per month, and that during a period of great depression and uncertainty in business of all kinds. The directors look for a great increase of telephones in Boston, which is slow to avail itself of the advantages of the exchange system compared with other New England cities. An increasing inquiry for private lines to cover long distances is noted. The report says: "There ought to be built the coming year at least 370 miles of extra-territorial lines, and entirely rebuilt about 90 miles now in use. In Boston and the suburban cities and towns there ought to be built 15 or 20 miles of stout pole lines, and in other cities and towns 20 or 25 miles. The average cost of construction per subscriber, including trunk, extra territorial and toll lines, was $51." The increase of gross earnings for the first quarter of 1883 was about $15,000 per month, "There is no reason to doubt that the increase in exchange earnings will continue, and that of extra-territorial lines will largely increase, during the succeeding quarters of the year. Your revenues will show an increase also from the following causes: The average receipts per subscriber for exchange service are but $3.66 per month, which is the minimum rate. This is caused by outstanding contracts at less than standard rates. As these contracts expire, and renewals are made, there will result an increase not only in gross but in net revenues." The construction needs of the company for the year ended Dec. 31 are $220,000. For new subscribers, $100,000; extra-territorial lines, $70,000; underground work in Boston, $50,000.

An Electric Railway for Switzerland.

A correspondent of the London *Times* writes as follows : "A project has been formed, and will, in all probability, shortly be executed, for uniting the Hôtel des Alpes, at Territet Chillon, and the Hôtel de Mont Fleury, which is situated on the steep mountain side immediately above Chillon, by an electric railway. The difference of altitude between the two hotels is 180 metres, and a few days ago the system which it is proposed to adopt was put to an experimental test. Rails of a gauge of 50 centimetres were laid on a part of the mountain for a length of 50 metres, and with a gradient of 30 to the 100. Between the rails is a rack for the reception of a toothed wheel, and at each end is a curve in order to show the advantage of the proposed system over the funicular system, which does not admit of the slightest curve. The wagon carries a dynamo-electric machine, which actuates by special gearing a toothed wheel on the axle in connection with the rack between the rails. An electric and an ordinary brake enable the conductor to modify the rapidity of descent at pleasure. The electricity was produced for the occasion, and in the first instance by a dynamo-electric machine of five horse-power, actuated by a portable engine. This engine it is intended to replace eventually by a turbine, for which there is ample supply of water. The apparatus for the transmission of the electric force to the receiver on the wagon consists of copper cables laid between the rails and alongside the rack, and the electric contact is established through the intermediary of mechanical brushes in the usual way. The carriage, in which were seated two, three and sometimes four persons, the whole, including the carriage, representing a weight of from 300 to 500 kilogrammes, went up the steep incline at the rate of from one metre to two metres per second, and the descent was completely controlled by the ingenious combination of the two brakes. In the event of the project being carried into effect, which depends, to some extent, on the approval of the Federal Government, the journey between the two hotels may be performed in seven or eight minutes. As, moreover, water is plentiful in Switzerland, there is no reason why every fashionable mountain should not have its own particular electric railway, and the time may come when idle or infirm tourists will ride luxuriously across the Mer de Glace and be carried on wheels half way up the Jungfrau and the Matterhorn. Already the people at Geneva, encouraged by the success of the experiment at Territet Chillon (Montreux), are proposing to utilize the waters of the Arve for the ascent of the Salève. But what will Mr. Ruskin say ?'

The Troubles of the Dimock Firm.

A suit has been begun in the Supreme Court by Gen. Alfred Sully against A. W. Dimock & Co., bankers and brokers, to recover the value of bonds and securities which he pledged with them, and which, it is claimed, they fraudulently rehypothecated. He also brings suit against the same defendants on a claim assigned to him by P. J. Goodhart & Co. On the 14th inst. the latter firm, according to agreement, tendered the defendants 3,000 shares of the Bankers and Merchants Telegraph Company at 119. They were refused, and Goodhart's agent was obliged to dispose of them in the market at 50. The suit is for $20,800, the loss on the sale of the stock. Judge Donohue has granted an attachment against the property of Dimock & Co. Wilberforce Sully, in another complaint, alleges that Dimock & Co. agreed, if he would buy Bankers and Merchants' Telegraph stock, to protect him against any loss on it, and take it from him at any time at the purchase price. When Dimock & Co. failed he parted with the stock, and sustained a loss of $124,774. Andrew F. Underhill has begun a suit of a similar nature to recover a loss of $13,175. The suits were all brought on the ground that the assignment was fraudulent. The assets in the hands of the assignee were seized on Wednesday on the attachment issued in the various suits. George Putnam Smith, the assignee, said the person who drew up the assignment had an extended experience in such matters, and declared that it was regular. The suits, Mr. Smith took it, were simply to establish the claims. The rehypothecations, it would be shown, were authorized by the owners of the securities.

A STREET RAILWAY AT TURIN, ITALY.—At the forthcoming Turin Exhibition a street railway will run from the Piazzo Carlo Felice to the principal entrance of the building. The motive power will be supplied by electric accumulators invented by Signor Nigra. The Nigra secondary batteries differ from those devised by M. Faure, in having the lead arranged in banks or festoons of wire and not in plates. At a trial with a Schuckert dynamo-electric machine and 30 accumulators weighing 22 pounds each, M. Nigra was able to run a four wheeled car carrying three persons at a speed of 12½ miles an hour.

DEPARTMENT OF INQUIRIES.

While we are pleased to answer in this department all questions of general interest to our readers, and do so without charge for time or expense, we must request those of our patrons who desire information for their personal interest, and who cannot be properly answered in this way, to send us with their request a small sum, say from $1 to $5, to pay for the time and the expense incurred for their exclusive benefit.

60.—CONDUCTIVITY OF WIRES.

"A claims a copper wire ½ inch in diameter will carry *more* of a current of electricity, than an iron wire $\frac{7}{8}$ of an inch in diameter and *coated* with $\frac{1}{8}$ of an inch of copper, making the latter wire the same size as the solid wire. B claims that, as conductors, they are equal. Which is correct?" X.
GREENVILLE, O.

The coated iron wire is a poorer conductor than the copper wire, and the proportion is about like this:

$16^2 \times 96 =$ conductivity of copper wire.
$(15^2 \times 16) + (31 \times 96) =$ " coated wire.

In this formula 16^2 = comparative area of cross-section of copper wire, 15^2 = comparative area of cross-section of iron wire uncoated, and 31 = comparative area of cross-section of copper coating. The numbers 96 and 16 represent the relative conductivities of copper and iron, respectively. The formula worked out shows that the copper wire has nearly four times the conductivity of the coated-iron wire; therefore has a greater capacity for carrying current without becoming over-heated. If the respective conductivities were more nearly equal the relative capacities for heat would have to be considered.

61.—DRUMMING OF RELAY.

"I have noticed, frequently, my relay drumming when there was no lightning on the wire. Will you please explain why or what makes this?" W. S. F.
MARION, N. C.

There are often earth currents approximately parallel with telegraph lines, which cause drumming of relays. Again, electricity of atmospheric origin, and of too small strength of current to be called lightning, may be conducted along the wire by reason of difference of potentials between the terminals. Also, induced currents and leakage from neighboring wires may give motion to your relay.

62.—DISCHARGES IN HIGH VACUA.

"Crooke's experiments in high vacua show molecules to be violently discharged from the negative electrode. Why is the discharge not from the positive electrode, as in the electric light?"
MANSFIELD, Mass. H. C. W.

The reason therefor is not known. The discharges which take place in partial vacua, almost complete vacua, and in compressed air, present almost anomalous phenomena. It seems that a complete vacuum does not conduct electricity, while a partial vacuum, of rarefied air, is a much better conductor than air under ordinary pressure. And further, that compressed air is progressively a poorer conductor as compression progresses.

63.—RELAY, WINDOW TUBES AND BATTERY.

"(1) Some relay and sounder magnets work better with currents passing through in one direction than when changed, and some work backward when current is reversed. Why? (2) When window tubes are undesirable will kerite or gutta-percha-covered wire do? And what is the smallest size that will safely do? (3) Will copper and zinc with sal-ammoniac make a suitable battery for open circuit work on a line one mile long?"
WHITE PLAINS, Va. W. R. S.

(1) This should not be if the iron cores of the magnet and the armature are of the best quality of soft, annealed iron. Perhaps the armature is polarized by reason of its poor quality confering upon it considerable coercive force. Remove the armature and test it by a compass needle for magnetism. Also test the magnet cores in a similar manner while the instrument is disconnected and the armature removed. If you do so with such a defective instrument, please let our readers know the result through our columns.

(2) Kerite or gutta-percha-covered wire will do. Have it heavily covered and at least No. 16 in size. Much smaller will answer under ordinary circumstances, but too small is too easily melted by lightning.

(3) Copper and zinc in sal-ammoniac solution will give a current. But such a cell has too little electromotive force and polarizes too rapidly to be of practical use. You had better use a pair consisting of carbon and zinc, such as is made by the Law Telegraph Co., or a Leclanché cell.

64.—SECONDARY IN TRANSMITTER.

"How many layers of No. 38 silk-covered wire on secondary coil of the Blake transmitter? I have made two transmitters; one of them is not plain enough. Is it possible to get too much wire in secondary coil? I have about twelve to fifteen layers. Would twenty layers make the coil stronger? Am using one cell of Leclanché battery. Can an induction coil be too strong?"
UNION CITY, Ind. E. A. B.

Twelve to fifteen layers are enough, provided the receivers are proportioned to the secondary. Twenty layers would make a greater electromotive force, other things being equal. Why not make your imperfect transmitter like the better one? Perhaps the trouble is with your primary circuit; at the electrodes, for instance. You can make induction coils too strong by putting too many layers, or rather convolutions, of wire, in either or both, primary or secondary circuits; because it will then be out of suitable proportion to the usual receivers and other apparatus.

55.—TROUBLE IN TELEPHONE SYSTEM.

"The trouble with Z's apparatus, noticed in No. 55 of issue of May 10, 1884, is, undoubtedly, in the primary circuit of the transmitter. If he uses a Blake's transmitter there are so many connections in the primary circuit the probability is that some one or more of them is bad. Those soldered connections are an unmitigated nuisance at best. Z's ground is good, or he could not hear well." A. J. W.
HASTINGS, Neb,

THE TELEGRAPH.

OFFICERS OF THE SOUTHERN TELEGRAPH CO.—The following persons were on Wednesday elected officers of the Southern Telegraph Company, which is controlled by the Bankers and Merchants': A. W. Dimock, President; A. J. Baldwin, Vice-President; J. G. Case, Secretary and Treasurer, and G. S. Mott, General Manager.

THE ELECTRIC SIGNAL TELEGRAPH CO.—The certificate of association of the Electric Signal Telegraph Company was filed in New York on May 17. Its telegraph lines are to run from New York through and across the intervening states to the city of Savannah, Ga., and thence to the cities and towns in the various states. The capital stock of the company is $250,000.

THE B. & O. IN MASSACHUSETTS.—The petition of the B. & O. company for special facilities on the New York & New England Railroad has been dismissed by the Railroad Commissioners. The case grew out of the refusal of the railroad company to deliver poles, wires, etc., at points between stations. The decision of the Commissioners is based upon the existing contract between the railroad company and the Western Union Company. That is held to be legitimately exclusive.

UNDERGROUND WIRES IN CHICAGO.—A preliminary injunction was secured on May 21 by the Chicago Sectional Electric Underground Company restraining the city of Chicago, the Baltimore and Ohio Telegraph Company, the Commissioner of Public Works and the Baltimore and Ohio Railroad Company from laying telegraph conduit pipes under Jackson or La Salle street, on the ground that a monopoly of underground telegraph business was given to the company by a city ordinance.

BUFFALO ELECTRICAL SOCIETY.—There was a good attendance at the meeting of the Electrical Society, on May 16, at the hall, 18 East Seneca street. The subject discussed was "Retardation in underground cables." The Society has received a very handsome gift in the shape of two valuable volumes on electrical work, from F. W. Jones, member of the New York Society. A vote of thanks to Mr. Jones was passed at the conclusion of the meeting in recognition of the high appreciation in which he is held by the Buffalo Society.

ELECTION OF B. & M. OFFICERS.—At a meeting of the stockholders of the Bankers & Merchants' Telegraph Company of Baltimore City, held there on May 17, Anthony W. Dimock, of New York; Robert Turner, Francis P. Stevens, J. G. Case, Bentley S. Bibb, G. S. Mott and William A. Dunn were elected directors for the ensuing year. The following officers were unanimously elected: President, Anthony W. Dimock; Vice-President, Robert Turner; Secretary and Treasurer, J. G. Case; General Superintendent, G. S. Mott; Attorney, Francis P. Stevens. It was stated that the company was in a prosperous condition.

GOVERNMENT TELEGRAPHS.—The report of the Senate Committee on Post-Offices and Post Roads, prepared by Senator Hill on the subject of the postal telegraph, was finally adopted May 22. In respect to the instructions given by the Senate to inquire whether the cost of telegraph correspondence has been raised by the stock dividends of the Western Union Company and by its various consolidations and leases, the committee believe they can best comply by giving a summary history of the increase of the debts, rentals and stock capital of the company, and such information as is attainable as to the actual value of the tangible property which it holds either by direct ownership or by lease. Such a statement is given in respect to the stock capital of the Western Union Company, amounting to $80,000,000; it has arisen, nearly the whole of it, from stock dividends. The bill offered by the committee proposes competition between the government and private companies.

THE UNDERGROUND WIRE BILL.—The Governor gave a hearing at Albany on May 22 on the Daly Underground Telegraph and Electric Light bill. The bill was opposed by various telephone and electric light companies in the city of New York. The Western Union Telegraph Company did not oppose it. The Edison Electric Light Company favored it. The arguments against the bill were that it was unconstitutional, and that the laying of subterranean wires in New York City was impracticable. Senator Daly and Delancey Nicholl, representing citizens of New York City, argued that there were no constitutional objections, and that there was no longer a doubt concerning the practicability of subterranean wires for telephone and electric light purposes. The Edison Electric Light Company had used underground wires for three years. The District Government of the city of Washington had been using the Waring cable system for fire alarm and telephone purposes since last fall; also the various departments of the General Government in Washington. Letters and telegrams were read from Capt. F. V. Green, District Commissioner; Gen. Hazen and Col. A. F. Rockwell attesting to the perfect working of these cables for all telegraph and telephone purposes. The Governor gave no intimation as to his action on the bill.

THE TELEPHONE.

CIRCLEVILLE, O.—We have received from Mr. Philip H. Korst, Manager, the May list of subscribers to the Circleville, O., Exchange, operated by the Central Union Telephone Co. The list shows 90 subscribers and 26 toll lines.

CAPT. LINA BEECHER is busily engaged perfecting some of the later developments of his portable telephone, now controlled by the American Portable Telephone Co. A great many inquiries are being made in regard to this apparatus, for which the uses promise to be innumerable.

ERIE INCREASE.—The Erie Telephone Company made a net gain of 214 subscribers in March, of whom 17 were in the Northwestern division, 177 in the Southwestern division, and 20 in the Cleveland division. The total number April 1 was 8,942, distributed as follows: Northwestern, 2,806; Southwestern, 4,215; Cleveland, 1,921.

ANTI-BELL TELEPHONE CO.—The instruments of this company, whose offices are at 82 Devonshire street, Boston, are sold outright, not rented. Being mechanical, they do not infringe the Bell patents. They will work satisfactorily for a mile or further when put up properly. On lines of from 500 to 2500 feet they work wonderfully well.

NEBRASKA TELEPHONE CO.—The General Manager of this company, Mr. Flemon Drake, informs us that they have no fewer than 530 subscribers at Omaha, and 270 at Lincoln. At Lincoln they are putting up 45, 50 and 60 feet poles in the main part of the town. They have just paid their fourth quarterly dividend of $2 per share, besides laying by a "surplus" and providing for reconstruction.

JAMAICA, WEST INDIES.—The Kingston, Ja., *Gleaner* of recent date says: "We understand that the West India Telegraph and Telephone Company are about to open an exchange at the corner of King and Port Royal streets, which will shortly be ready for business. It is expected over thirty merchants will have subscribed for the telephone by the end of this week, and as it is proposed by the company to connect the post, telegraph and fire brigade offices with the exchange, the great advantage that will accrue to subscribers can be readily imagined."

CAUSE AND CURE OF A FIRE.—The particulars of an odd occurrence are given by the *Manufacturers' Gazette* of May 17: During a late storm which raged with great force at Greenville, Mass., lightning ran by the telephone wire to the Windsor Mill. There is no telephone in the mill and the wire is disconnected just outside the building. The lightning was led by the wire to the corner of the mule and weaving rooms, and entered the building under the jet. It followed the water-pipe and set the sprinklers going, and at the same time fired the stock in the mules. By this singular provision of an active extinguishing agent at the moment the fire started, serious loss was prevented, as the fire was soon drowned out.

TELEPHONE FIRE ALARMS.—The Mobile, Ala., *Register*, of May 13, mentions the following little incident: At a quarter past twelve o'clock Sunday morning fire was discovered in Mr. T. G. Bushe's kitchen, on Government, near Ann street. The coachman of Dr. Ketchum saw the flames and carried the alarm to Mrs. Ketchum, who made use of the telephone. The message was thus carried through the central office to the guardhouse, and an alarm was sounded. Meanwhile box 61 was shoved up, confirming the telephonic report. The Fire Department repaired to the scene and quickly extinguished the flames. The loss is put at $150. Mr. Bush told the superintendent of the Telephone Exchange yesterday that beyond a doubt the telephone saved his house, by bringing the department at once to the scene of the fire.

THE PROVIDENCE TELEPHONE CO.—The Providence Telephone Company, at its annual meeting on May 16, chose these directors: Henry Howard, Henry G. Russell, Henry C. Cranston, R. G. Hazard, 2d, F. H. Peckham, Jr., R. M. Larned, James H Chace, H. F. Barrows, C. R. Greene, J. U. Starkweather. The treasurer's report showed: Capital stock, $200,000; plant, $197,873.67; indebtedness, $18,098.01; profit and loss, $15,971.70; cash in the treasury, $2,136.31; increase of capital, $50,000; expended for plant, $34,265.43; paid royalty to the American Bell Telephone Company, $34,265.43; commission, $1,194.49; dividends, including stock dividends, $43,000; expenses, $40,203.03; cash on hand, May 1, 1833, $1,424.15; May 1, 1884, $18,098.01; gross earnings, $121,699.15; expenses, $75,662.85; net earnings, $46,036.30.

THE ELECTRIC LIGHT.

AN EDISON 1,000-LIGHT PLANT.—The Circleville, O., Edison Illuminating Co. are putting in a 1,000-light plant, and expect to have it running in 30 days.

LEADVILLE, COL.—The Leadville, Col., Electric Light Company, just started, have two No. 7 45-light Brush machines. The lamps are burning nicely and give great satisfaction.

THE OLMSTED LIGHT.—The Olmsted Electric Light Co., under the name of the People's Electric Light Co., at Binghamton, N. Y., are giving, they claim, 49 arc lights of 2,000 candle power nominal on a 50-light machine, with a 40 h. p. Shapley & Wells engine, 60 lbs. of steam.

MENDOTA, ILL.—The Mendota Electric Light Co., of Mendota, Ill., has completed its organization with the following board of officers: P. H. Cooper, President; Max A. F. Haass, Secretary; E. A. Bowen, Treasurer; L. R. Curtiss, Superintendent and Electrician. The company has adopted the Thomson-Houston system, and ordered a 25-light dynamo, to be run by an A. L. Ide 50 h. p. engine.

NOTES FROM ILLINOIS.—The Thomas Electric Light and Power Co., of Ottawa, Ill., has 75 Thomson-Houston lights, and contemplates extension by the addition of an incandescent plant. The Twin City Gas Co., of La Salle, Ill., has a plant of 25 Thomson-Houston lights now running, and its order has been given for another machine of the same capacity. The power is obtained at the Union Coal Shaft from an Ide Automatic 50 h. p. engine.

AMATEUR ELECTRIC LIGHT OUTFITS.—Mr. A. V. Meserole, 22 New Church street, has a miniature electric light outfit on exhibition. The incandescent lamp he is using is of about two ohms resistance, and is run with six small cells. It gives a light of about one candle power. He claims that he can run lamps of 5 or 6 ohms up to several candle power, continuously, at very little expense, with a patent storage system that he has. He is prepared to supply these outfits as useful to experimenters, physicians and others.

PROGRESS IN BROOKLYN.—Mayor Low has signed the Common Council resolutions granting franchises to Pope, Sewall & Co. to carry on the business of electric lighting in the Western District, and to Charles Cooper & Co. in the Eastern District of the city. The companies are required to begin operations by May 29. Mr. Horace E. Deming, counsel for Pope, Sewall & Co., had a consultation on May 19 with Mayor Low and Corporation Counsel Taylor, and all the details of the compact between the city and the company were arranged. The amount of the bond the company is to give to the city was fixed at $50,000.

MORE STREET LIGHTING IN NEW YORK.—We offer the following, from the *Evening Telegram* of May 22, for the consideration of the *Alta California*, which has said that the authorities here want no more electric light: Under the resolution introduced by Alderman Miller and recently adopted by the Common Council,

the following streets were lighted by electricity last night for the first time: Bleecker street, from Carmine to Eighth avenue; Fourteenth street, from Eighth avenue to North River; Ganse-voort and Abingdon squares. The new style of illumination gave general satisfaction and was thought a great improvement.

MISCELLANEOUS NOTES.

ELECTRICAL JOURNALISM.—In our notice of the *Canadian Electrical News* last week, the name of Mr. J. Horne was erroneously printed as Mr. J. Howe.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—A meeting of the Council was held on May 20, when various committees were appointed, the nominations of new members were considered, and the rules and the proceedings of the last general meeting were ordered to be printed.

THE ELECTRO CHEMICAL EQUIVALENT OF SILVER.—The quantity of silver in grams deposited by a coulomb of electricity is generally called the electro-chemical equivalent, and the figure is usually given as .0011340. Under the C. G. S. (centimeter-gramme-second) system of units, the figure becomes .011340, for one coulomb is one-tenth of the C. G. S. unit of quantity. A recent determination of Lord Rayleigh, however, makes the corresponding figures .0118 and .00118. It follows that a current of an ampère will deposit 4.025 grams of silver per hour. Lord Rayleigh's result, says *Mechanics*, was obtained with great care, and is probably as accurate as we may expect to get it for some time. It will prove very useful in calibrating electric-current meters. It was obtained with a silver-plate voltameter containing nitrate of silver solution.

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Thursday at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—Am. Cable, a 55; American Rapid, b 50, a 65; B. & M. Co., b 40, a 48; Commercial Telegram Company Pref'd, a 109; Commercial Telegram Common, a 95; Harlem District Telegraph Co., b 2, a 5.50; Manhattan Telegraph, b 10, a 85; Mexican, b 125, a 147; Mutual Union, b 11, a 12; Postal Telegraph (stock), b 5, a 5.50; Postal Telegraph Bonds, 1st, 6 per cent. b 47.75, a 48.75; Western Union, b 53½, a 53⅝.

The official statement of the Western Union Telegraph Company for the year ended Dec. 31, 1883, shows gross revenues of $19,571,476.41; expenses (including all expenses of operating, maintenance, reconstruction, taxes, rent of leased lines, etc.), $12,928,963.14; net profits, $6,642,513.27. From which there was paid four quarterly dividends of 1¼ per cent. each, $5,599,-125.43; interest on bonded debt, $426,247.30; sinking funds appropriation, $40,094; surplus for the year, $577,046.54.

TELEPHONE.—American Bell, a 150; American Speaking, b 110, a 125; Currier Telephone Bell, b 3; Colombia and Panama, b 24.50, a 25; Continental, b 15; Dolbear, b 5, a 10; Globe, b 5.50, a 6; Hudson River, b 60, a 90; Inter-Continental, b. 95, a 1.25; Mexican Central, a 2.50; Molecular, b 7, a 13; New York, a 85; New York and New Jersey, a 80; New York and Pennsylvania, b 50, a 80; New York State Overland, b 15, a 20; Overland, b 10, a 12; People's, b 8.75; People's (N. E.), b 1, a 10; Solenoid, a 90; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, b 2, a 2.50; West India Telegraph and Telephone, b 1.25, a 1.50.

Advices from the agent of the Inter-Continental Telephone Company (subsidiary to the Tropical Company), show that the gross receipts of the Caracas exchange for March were $3,075.39; expenses and construction, $1,257.01; net profits, $1,818.38; gross receipts 12 months to May 6, $25,735, including $7,015 from trunk lines. The number of subscribers May 6 was 312. The trunk line messages average 130 per day at 20 cents each. The legitimate operating expenses are $900 per month, or $10, 800 per year, and but for continued construction the company would look for net profits of $15,000 per year.

The Boston *Advertiser* of May 22 quotes the local market as follows: In telephone stocks, Bell declined 1 to 151; New England ⅛ to 26; Erie advanced ¾ to 26¾.

ELECTRIC LIGHT.—American, b 2, a 4; Baxter, b 22, a 22.50; Brush, b 50, a 80; Brush Illuminating, b 45, a 70; Daft, a 90; Edison Illuminating, b 55, a 75; Edison Isolated, a 90; Edison European, b 8, a 15; Excelsior, b 20; Swan Incandescent, b 15, a 40; United States, b 75, a 95; United States Ill. Co., a 90.

Kohlsaat & Co., No. 30 Pine street, furnish the following quotations for miscellaneous securities:

	About.		About.
American Elec. L.	8	Am. Bell Telephone	152
Brush Electric	60	Mexican Telephone	20
Daft Electric Illum	50	N. J. & N. Y. Tele	60
Edison Electric	75	People's Tele	22
U. S. Electric Light	95	N. Y. & Penn. Tele	62

BUSINESS NOTICES.

PUSH BUTTONS AND BOX BELLS.—The Redding Electrical Co., of Boston, have for sale at cost a large lot of push buttons and box bells, as detailed in our advertising columns. They are closing them out, and the opportunity is a good one, as the articles are of the highest quality and finish.

HILL, CLARKE & CO.—This firm, of 36 to 42 Oliver street, Boston, and 800 North Second street, St. Louis, have issued a large and handsome descriptive catalogue of the light machinery and small tools in which they deal. The book contains over 150 pages, and illustrates over 300 articles. The information given is full and interesting. Among the tools and machines embraced are many of special importance to electricians and electric light superintendents, such as shafting, hangers and pulleys, chucks, lathes, gauges, forges, emery and corundum wheels, drilling machines, speed indicators, rubber belting. The prices quoted are moderate for first-class goods. We have seen few catalogues prepared with so much care and taste as this displays.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 9 Murray Street, New York.

PATENTS DATED MAY 6, 1884.

Automatic Circuit-Closing Device; Charles T. Ross, of New York, N. Y. 298,121

An easily fusible plug or cap keeps a spring from a contact which would close an electric alarm circuit. When submitted to heat, as at the breaking out of a fire, the plug or cap is fused and the the spring is then free to close the circuit.

Circuit-Closer for Electric Clocks; Vitalis Himmer, of New York, N. Y., Assignor to Ida C. Himmer, of same place 298,301

By means of shunting the circuit, the wear from burning the contact points is much decreased.

Electric Bell and Annunciator; John D. Gilchrist, of Ishpeming, Mich. 298,080

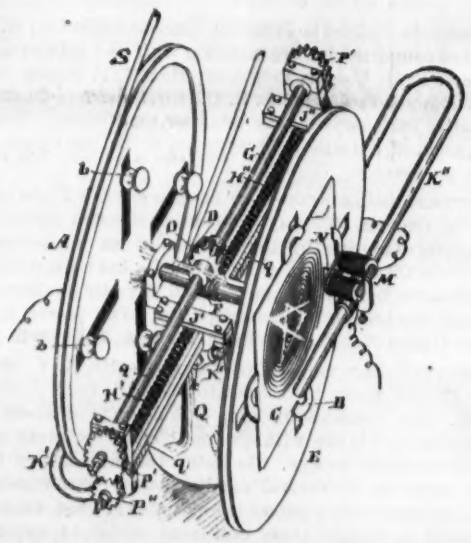
By the movement of the hammer of the bell a catch is moved, so that a pointer tips to an angle by its weight.

Electric Circuit Breaker; Edward Weston, of Newark, N. J, Assignor to the United States Electric Lighting Co., of New York 298,144

A compressed spring rapidly moves a lever from contact when the key is moved either way, to operate a catch which engages the lever in its position of contact.

Automatic Electric Copying and Engraving Machine; Albert Schmid, of Zurich, Switzerland .. 298,030

The operation of the machine is as follows: The original picture, drawing, writing, or graphic production which is to be



copied, having been executed upon a metallic plate by means of a well-adhering and non-conducting material or color, or on paper by means of a metallic ink, is fastened to the centre of the disc *A* by means of its clamps and binding-screws. The plate *C*, on which the copy is to be engraved or drawn, is in the same manner fastened to the disc *E*. After having placed the point of contact *L* and the drawing-point or chisel *N* in the centres of their respective discs *A* and *E*, the machine is put in motion. As the discs rotate, the tracing-point and the drawing-point or chisel are each moved slowly and uniformly outward from the centre of their discs on a horizontal plane, and they will each describe a spiral path on their plates. The tracing point or wheel glides over the surface of the original plate, while the drawing point, pin or chisel is held away from the plate or pressed against it by the armature of the electro-magnet, either at the interruption or at the closing of the electric circuit, as the work to be executed admits of. When the copy or engraving is to be of a different size from the original, interchangeable cog wheels P' P'' are used, which give a slower or faster movement to the feed-screw H'', and consequently to the chisel or point *N*, than is given to the feed-screw H' and the tracing-point *L*, according to whether the copy is to be smaller or larger than the original, and proportionate to the difference in the scale or size of the two, whereby an accurately enlarged or reduced reproduction is drawn or engraved on the plate *C* by means of the spiral path of the tool, which is interrupted or marked by the line of the picture, drawing, writing, &c., of the original.

Electric Motor; Levi W. Stockwell, of Cleveland, O., Assignor to the Cleveland Electric Motor Co., of same place 298,130

The field magnet is annular, and has two polar faces within the ring. The armature has four radial arms, the commutator has four segments and there are four brushes connected in two pairs.

Electric Annunciator; Paul Seiler, of San Francisco, Cal. 298,242

Consists in providing each floor or section of a building with an individual annunciator located at the station-board, and then connecting corresponding rooms upon the several floors with a single annunciator. The connections are such that the two annunciators show the floor and room on that floor, respectively, from which the signal is sent.

Electric Circuit Connector; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Co., of New York 298,326

A plug of insulating material having suitable electric wires insulated therein is introduceable to or removable from a socket, and is fastened therein by means of lugs on the plug. The lugs pass through channels in the mouth of the socket into a circular groove within. Springs in the socket make contact with the ends of the wires in the plug.

Galvanic Battery; Chas. L. Clarke, of Manchester, England, Assignor to the Domestic Electrical Manufacturing Co., of Boston, Mass 298,175

An oxide of mercury is used as the depolarizing agent, and a solution of potassic or sodic hydrate as the exciting fluid.

Holder for Incandescent Lamps; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Co., of New York 298,142

A variation of the details of No. 298,143.

Incandescent Lamp; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Co., of New York 298,325

The carbon filament is formed into a flattened spiral, so that a carbon of greater light than usual may be used in a globe.

Incandescent Lamp Fixture; Edward Weston, of Newark, N. J., Assignor to the United States Electric Light Co., of New York 298,327

Consists in improvements in devices for connecting with the conductors running through the chandeliers, safety or fusible conducting-strips, for preventing an abnormal flow of current.

Laying Underground Electric Wires; Joel H. Page, of Philadelphia, Pa., Assignor of one-half to Blanch Carrie King, of same place 298,020

The conduit is made in sections for extension in length, and in segments for closing or opening. The wires are held stretched and apart in position until a heated plastic compound is poured in, and hardens. Angles and branches in segmental parts are provided.

Method of Testing Carbon Conductors for Incandescent Lamps; Edward Weston, of Newark, N. J., Assignor to The United States Electric Lighting Co, of New York, N. Y. 298,141

Before the carbon filaments are finally mounted in their globes they are tested by submitting them to momentary currents of electricity. The imperfect spots, if any, are heated to a temperature which makes them momentarily visible, and are thus detected.

Railway Signaling Apparatus; Caleb H. Jackson, of Allegheny, Pa. 298,209

On converging tracks apparatus is provided whereby a danger signal on one track is set and locked by the approach of a train on the other track.

Rheostat; John Doyle, of Hoboken, N. J., Assignor to himself and C. Coles Dusenbury, of White Plains, N. Y. 298,073

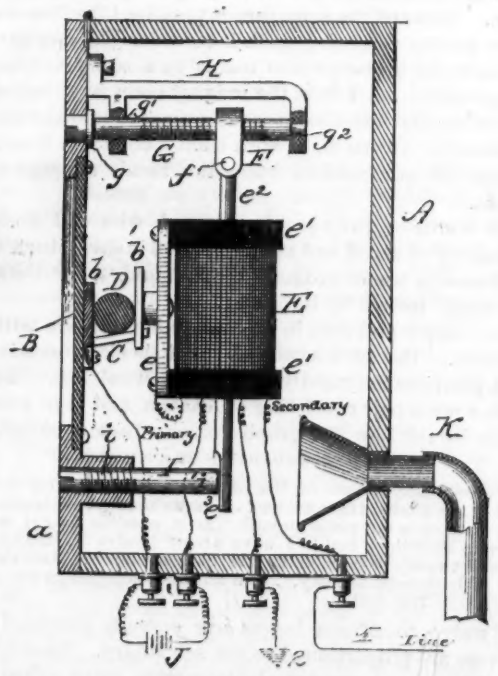
A lot of perforated discs punched from thin sheet aluminium, or made of thin copper with aluminium dust pressed into its surface, are strung on a rod which has a screw-thread and nut on one end, so that the discs may be compressed. A sliding spring-contact is movable over the edges of the discs, so that any desired number may be included in circuit. The varying degrees of compression, which may be imparted by the nut, serve as a means of varying the resistance, in addition to the movements of the sliding contact.

Socket for Incandescent Lamps; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Co., of New York 298,143

The lamp globe may be turned in either direction in its socket. The contacts within the socket are made by springs which press upon a metal pin and a metal cap respectively on the lamp globe. Lugs on the cap fit in a circular groove in the holder, and the lugs are admitted to the groove by suitable channels of admission.

Telephonic Transmitter; Henry Clay, of Philadelphia, Pa., Assignor to the Clay Commercial Telephone Co., of same place 298,286

The operation is as follows: The initial adjustment of the screw *G* being made for obtaining corresponding contact of the electrodes, the bar *I* is adjusted until its end *i'* nearly but not quite contacts with the end e^3 of core e^2. The sound-waves vibrating the diaphragm *B* vary the strength of the battery-



current and set up corresponding induced currents in the secondary circuit of the coil *E* in the customary manner, and correspondingly magnetize the core e^2, which in turn is proportionately attracted by bar *I*, and thereby regulates the force of contact of the electrodes in unison with the vibrations of the diaphragm, to obtain a more efficient variation in the battery-current; or, in other words, the coil *E* is not only an induction coil, but also acts as a governor for regulating the force of contact of the electrodes and a damper for the diaphragm, which is prevented from having prolonged vibrations by the gravity of the induction-coil. The variations of the magnetic charge induced in core e^2 variably magnetize bar *I* for regulating the force of contact of the electrodes.

Secondary Electric Clock; Ida C. Himmer and William F. Weisgerber, of New York, N. Y., Assignors to said Ida C. Himmer 298,205

Each electric impulse from the primary clock moves an armature into a position which causes its attached pawl to engage a toothed wheel. When the electric current is stopped the armature and attachments move to their former position, and in doing so move the toothed wheel one tooth forward. The wheel is prevented from moving at any other time by locking devices, working automatically at proper times.